

# The Keck Interferometer: V<sup>2</sup> Capabilities, Nulling Key Science, and Astrometry

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## Project Objective

Combine the two Keck Telescopes as an interferometer

- Adaptive optics used on both telescopes
- 1.6 and 2.2  $\mu\text{m}$  active fringe tracking for high sensitivity measurements of a range of astrophysical objects
- 10  $\mu\text{m}$  nulling mode to measure exo-zodiacal dust around nearby main sequence stars

## Recent Results

The Keck Interferometer (KI) was developed by JPL, the Michelson Science Center and the W.M. Keck Observatory. KI is fully operational in both visibility amplitude and nulling modes and is available to the US community.

- KI has observed a range of objects, including disks around young stars, novae and active galactic nuclei
- KI made the first infrared interferometry observation of an object outside our galaxy (the nucleus of NGC 4151)
- KI is currently the most sensitive near-infrared, long-baseline interferometer in the world



## V<sup>2</sup> Capabilities

KI is open to all US-based proposers through the NASA proposal process.

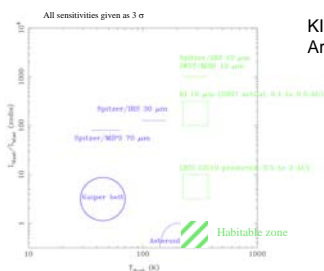
Visibility amplitude characteristics

- 5 milliarcsec fringe spacing
- $R < 12$  (adaptive optics)
- $K < 9.9$  or  $H < 9$  (fringe tracking)
- 42 pixel (resolution  $\sim 200$ ) mode available
- Service observing with full science support

## Nulling Key Science

The KI Nuller (see Colavita poster) was developed to survey nearby stars for exo-zodiacal dust. Three teams were selected to conduct this survey, which will observe 45 stars over the next year.

For a G2V star the sensitivity in a 3-hour block corresponds to a limit of  $L_{\text{dust}}/L_{\text{star}} = 3 \times 10^{-5}$  (3 sigma) or  $\sim 300$  times our solar system's zodiacal cloud.

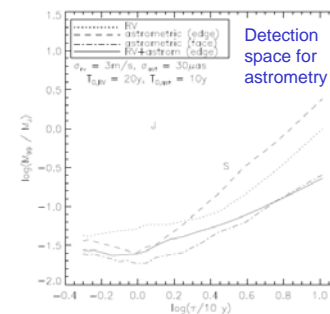


KI And LBTI Surveys Are Complementary

- With their different angular resolutions, combining data from KI and LBTI constrains the distribution of material within the habitable zone
- KI and LBTI will detect different levels of excess due to the different fringe patterns between 25 mas and 130 mas (0.25 to 1.3 AU at 10 pc)

## ASTRA Project

ASTRA is an NSF-funded project to add phase-referencing and astrometry to KI. The astrometry mode will measure the true mass of many known radial velocity planets and search for new planets in those systems. It can also search for planets around young stars which are too active for precise radial velocity observations.

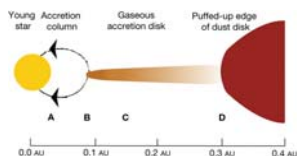


## Benefits to NASA and JPL

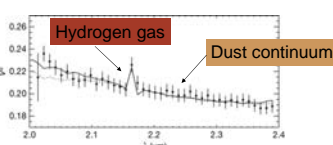
KI is a fully operational facility which gives the US community access to a state-of-the-art near and mid-infrared interferometer. The Key Science exo-zodiacal survey science will be used in planning future planet finding missions, while the general astrophysics covers many areas of scientific interest to NASA.

## Publications

KI has 17 refereed science publications:  
see [http://msc.caltech.edu/software/KISupport/KI\\_biblio.html](http://msc.caltech.edu/software/KISupport/KI_biblio.html)  
for the complete list



The higher spectral dispersion mode in K band traces the gas size in the young stellar objects MWC480 (Eisner, 2007)



First results with KI Nuller reveal structure of nova outburst gas/dust shell on 5 milli-arcsec scale (Barry et al. 2008)

